ICT 2206 – Internet Programming

Individual Project – First Submission

Title: **Design and Implement a Network Infrastructure with VLANs, DHCP Servers, Firewalls, and Internet Connectivity**

Objective:

Design a network for a mid-sized company using Cisco Packet Tracer. The project requires the implementation of VLANs for department separation, DHCP servers for automatic IP assignment, a firewall for network security, and internet connectivity for external communication.

Intended Learning Outcomes:

By completing this project, you will demonstrate skills in VLAN configuration, inter-VLAN routing, dynamic IP address assignment, firewall setup, and basic internet connectivity for an enterprise network.

Scenario:

You are a network administrator for a company that has *n* user departments, *m* administrative departments, *p* academic departments, and one security and emergency response department. Each department must be assigned to its own VLAN for logical separation and security. The company also requires dynamic IP address assignment using DHCP, with a single DHCP server set up in the router.

Network Requirements:

1. **Departments (VLANs)**:
    - Each VLAN should be assigned numbers in the range 10, 20, 30, …
    - Each VLAN should be assigned separate /24 address ranges from any private IP address range you like.
2. **Devices**:
    - Each VLAN should be serviced with a separate Layer 2 switch
    - 1 Router (Layer 3, configured as a gateway and firewall)
    - 1 Internet Cloud (Simulated internet access)
    - At least 3 PCs for each department

3. **DHCP Configuration**:
    - For each VLAN, the upper half of the allocated address range should be provided through DHCP.
4. **Internet Connectivity**:
    - Connect the router to an ISP via the internet cloud (use simulated connectivity).

Calculation of Paramters:

n – Divide the last three digits of your registration number by 7 and take the remainder. Add 1 to the remainder.

m – Divide the last three digits of your registration number by 3 and take the remainder. Add 1 to the remainder.

p – Divide the last three digits of your registration number by 5 and take the remainder. Add 1 to the remainder.

Tasks to Complete for Submission 01:

1. **Network Topology Design**:
    - Create the basic network topology.
    - Assign VLANs to the appropriate switch ports for each department.
    - Each switch should have 1 port assigned to the default VLAN.
    - The default VLAN should be tagged in all aggregating (trunking) ports.
2. **VLAN Configuration**:
    - Configure VLANs on each switch for all departments.
    - Assign the correct ports to the respective VLANs.
    - Configure trunk links between switches and the router for inter-VLAN communication.
3. **Router Configuration**:
    - Configure Inter-VLAN routing on the router using sub-interfaces for each VLAN.
    - Assign IP addresses to each VLAN interface (Router on a Stick configuration).
    - Set up static routing or default routing to the simulated internet.

4. **DHCP Server Setup**:
    - Configure a DHCP server on the router to automatically assign IP addresses to devices in each VLAN.
5. **Internet Connectivity**:
    - Configure internet access through the router using a default route pointing to the internet cloud.
    - Test connectivity from the internal network PCs to ensure they can access the web.
6. **Testing and Verification**:
    - Ensure each department's devices automatically get IPs in the correct subnet.
    - Ensure that devices in each VLAN can communicate with each other and access the internet.
7. **Documentation**:
    - Document all configurations (commands) for the switches and the router.

Submission Requirements:

- Packet Tracer Project File (.pkt)
- Text file with configuration commands for each device (switches, router)
